CLAIMS

What is claimed is:

1. A trailer mounted mobile apparatus for dewatering and recovering formation sand from an oil-sand-water mixture contained in a remotely located field oil storage tank, said tank having a flanged fluid drain hole located at the bottom thereof, and a flanged fluid inlet hole located above said flanged fluid drain hole, said trailer mounted mobile apparatus towable by a truck, the trailer mounted mobile apparatus comprising:

   a. a furcated conduit adapted for connection to said tank flanged fluid drain hole, said furcated conduit having a first branch and a second branch, said first branch having a flanged first end and a flanged second end, said second branch having a first end connected to the first branch and a second branch flanged second end, wherein the axis of the second branch is angled away from the axis of the first branch forming an inter-axial angle of less than ninety degrees and wherein said flanged first end of the first branch is connected by connection means to the tank flanged fluid drain hole, and wherein the first and second branches have a diameter equal to the diameter of the tank flanged fluid drain hole;

   b. high pressure water injection means for injecting high pressure water into the formation sand within the tank through the first branch of the furcated conduit in order to create a sand-water slurry within the tank while maintaining the oil contained within the tank substantially undisturbed;

   c. means for withdrawing said slurry from the tank by way of the second branch of the furcated conduit;

   d. means for dewatering the slurry said dewatering means located remote from the tank; and,

   e. means for transporting the slurry from the tank to said remote slurry dewatering means.

2. The apparatus as claimed in claim 1 wherein the high pressure water injection means for injecting high pressure water into the formation sand within the tank through the first branch of the furcated conduit in order to create the sand-water slurry within the tank comprises:

a. a pipe having a pipe first end and a pipe second end and a length adequate to transverse the length of the furcated conduit plus the radius of the tank so that said pipe first end is proximate to the vertical axis of the tank and said pipe second end extends from the first branch flanged second end, wherein the act of inserting the pipe into the first branch flanged second end creates an annulus within the first branch, said annulus sufficiently dimensioned to permit an adequate flow of sand-water slurry from the tank and into the second branch of the furcated conduit, and wherein the annulus at the first branch flanged second end is sealed by suitable sealing means to prevent leakage of sand-water slurry there from;

b. a nozzle attached to the pipe first end said nozzle perforated to create a spherical spray pattern of high pressure water within the formation sand, said spherical spray pattern adapted to mix the formation sand and water within the tank to create the sand-water slurry without causing the oil stored within the tank to substantially mix with the sand-water slurry; and,

c. a source of high pressure water for injection into the formation sand connected to the pipe second end.

3. The apparatus as claimed in claim 2, wherein said source of high pressure water for injection into the formation sand comprises:

a. a reservoir of water;

b. a first pump having a suction intake connected to said reservoir of water by an intake conduit, said pump having a discharge connected to a discharge conduit wherein the discharge conduit has a discharge end and wherein said discharge end is connected to the pipe second end and further wherein said pump creates a discharge pressure and flow adequate to cause mixture of the sand and water within the tank to form the slurry; and,

c. a control valve mounted on the discharge conduit to control fluid flow into the pipe second end.

4. The apparatus as claimed in claim 3 wherein said high pressure water injection means further comprises forcing means for forcibly inserting the pipe into the formation sand, said forcing means comprising:

a. a rectangular frame removeably mounted by mounting means to the second flanged end of the first branch of the furcated conduit, said rectangular frame comprising:

i. a first channel-shaped half-frame having a first back member, a first side member and a second side member;

ii. a second channel-shaped half-frame having a first back member, a first side member and a second side member;

wherein said first channel-shaped half-frame and said second channel-shaped half frame have identical proportions, and further wherein the second channel-shaped-half frame is positioned opposite the first channel-shaped half frame so that their respective open ends facing each other and further wherein the second channel-shaped half-frame is positioned partially within the first channel-shaped half-frame in a sliding alignment so that the first side member of the first channel-shaped half frame is adjacent to and parallel to the second side member of the second channel-shaped half frame and wherein the second

side member of the first channel-shaped half frame is adjacent and parallel to the first side member of the second channel-shaped half frame, and further wherein each of the first and second side members of each of the first and second channel-shaped half-frames have inside and outside surfaces;

b. a first protruding member fixed to the outside surface of the second side arm of the second half-frame wherein said first protruding member is perpendicular to the second side arm of the second half-frame, wherein the first protruding member includes a first threaded aperture having an axis parallel to the second side arm of the second-half frame and further wherein said axis intersects the first back member of the first half-frame at a point adjacent to the intersection of the first half-frame first back member and first side member;

c. a second protruding member fixed to the outside surface of the second side arm of the first -half frame wherein said second protruding member is perpendicular to the second side arm of the first half-frame, wherein the second protruding member includes a second threaded aperture having an axis parallel to the which is parallel to the first side arm of the second half-frame and further wherein said axis intersects the first back member of the second half-frame at a point adjacent to the intersection of the second half-frame first back member and first side member;

d. a third threaded aperture located where the axis of the first threaded aperture intersects the first half-frame first back member, said third threaded aperture having a thread and diameter identical to the first threaded aperture;

e. a forth threaded aperture located where the axis of the second threaded aperture intersects the second half frame first back member, said forth threaded aperture having a thread and diameter identical to the second threaded aperture;

f. a first threaded rod having a length at least equal to the length of the first half-frame first side member, said first threaded rod having a first end threadably engaged with

the third aperture, the first threaded rod having a second end threadably engaged with the first aperture, so that when the first threaded rod is turned in a clock-wise direction the first back members of the first and second half-frames are drawn together and when the first threaded rod is turned in a counter-clockwise direction the first back members of the first and second half frames are moved apart;

g. a second threaded rod having a length at least equal to the length of the second half-frame first side member, said second threaded rod having a first end threadably engaged with the forth aperture, the second threaded rod having a second end threadably engaged with the second aperture, so that when the second threaded rod is turned in a clock-wise direction the first back members of the first and second half-frames are drawn together and when the second threaded rod is turned in a counter-clockwise direction the first back members of the first and second half frames are moved apart;

h. a first handle fixed to the first end of the first threaded rod for turning the first threaded rod; and,

i. a second handle fixed to the first end of the second threaded rod for turning the second threaded rod.

5. The system as claimed in claim 4 wherein said forcing means further comprises:

a. a first drive wheel mounted on an axle, said axle positioned within the first half-frame, said first drive wheel positionally fixed with respect to the first half-frame and moveable with the first half-frame, wherein the first drive wheel includes an engagement surface and is adapted to move into frictional engagement with the pipe;

b. a second drive wheel mounted on an axle, said axle positioned within the second half-frame, said second drive wheel positionally fixed with respect to the second

half-frame and moveable with the second half-frame, wherein the second drive wheel includes an engagement surface and is adapted to move into frictional engagement with the pipe at a position which is opposite the place of frictional engagement of the first drive wheel with the pipe; and,

c. a plurality of drive gears mounted to the frame, said drive gears adapted to drive in a forward and reverse direction, a drive chain, said drive chain connecting each of the drive wheels to a motor so that each of the drive wheels counter-rotate and wherein each of the drive wheel frictional engagement surfaces are in frictional contact with the pipe and act to provide a motive force to the pipe thereby pushing it into the formation sand within the tank.

6. The apparatus as claimed in claim 5 wherein said motor is hydraulically powered and wherein said hydraulic power is generated remotely from said truck.

7. The system as claimed in claim 6 wherein the frictional engagement surfaces of each drive wheel are fabricated from a heat resistant polymer.

8. The system as claimed in claim 1, wherein said means for withdrawing the slurry from the tank by way of the second branch of the furcated conduit comprises:

a. the annulus within the first branch of the furcated conduit wherein said annulus permits the flow of slurry from the tank and discharge from the second branch flanged second end;

b. a screen chamber having an inlet end and a discharge end said screen chamber attached to the second branch second flanged end wherein the screen chamber is adapted to trap debris within the slurry that is not suited for pumping;

c. a suction creation means mounted within a housing said housing having an inlet and a discharge end wherein the housing inlet is attached to the discharge end of the

screen chamber, and wherein said suction creation means is adapted to create a suction across the pump housing in order to promote the removal of slurry from the tank; and,

d. a reduction nozzle having an inlet and a discharge end, wherein said inlet of said reduction nozzle is attached to said discharge of the housing, and wherein the reduction nozzle is adapted to accelerate the flow of slurry into an adjacent reduction nozzle discharge conduit attached to the discharge end of the reduction nozzle.

9. The apparatus as claimed in claim 8, wherein the suction creation means comprises a disc mounted within the housing, wherein said disc has an upstream face and a down stream face, and wherein the disc is apertured at its centre to permit the flow of slurry there through, and further wherein the disc further includes a plurality of water discharge ports positioned on said downstream face, and further wherein each of said plurality of water discharge ports are in communication with a source of high pressure water, and further wherein said source of high pressure water is directed to the plurality of water discharge ports by a plurality of channels located within the disc, said plurality of channels connected to a source of high pressure water.

10. The apparatus of claim 3 further comprising means for injecting low pressure water into the tank so that the slurry maintains an adequate water content for pumping, said means for injecting low pressure water comprising:

a. a reservoir of water;

b. a second pump having a suction intake connected to said reservoir of water by a intake conduit, said second pump having a discharge connected to the tank by a discharge conduit wherein the discharge conduit has a discharge end and further wherein said discharge conduit discharge end is connected to the flanged fluid inlet hole of the tank and further wherein the discharge pressure of the second pump is

less than the discharge pressure of the first pump while maintaining an adequate flow of low pressure water to the tank to maintain a desired slurry consistency; and,

c. a control valve mounted on the discharge conduit to control fluid flow into the flanged fluid inlet hole of the tank.

11. The apparatus as claimed in claim 1 wherein means for transporting the slurry from the tank to the remote slurry dewatering means comprises:

a. a third pump adapted to pump a slurry, said third pump having a suction intake port and a discharge port;

b. a third pump suction intake conduit attached to the third pump suction intake port, said third pump suction intake conduit in turn attached to the reduction nozzle discharge conduit discharge end;

c. a control valve installed on the third pump suction intake conduit; and,

d. a third pump discharge conduit attached to the third pump discharge port, said third pump discharge conduit adapted to transport the slurry from the third pump to said remote slurry dewatering means.

12. The apparatus as claimed in claim 1 wherein said remote slurry dewatering means comprises a trailer mounted rectangular container comprising:

a. a volume sufficient to contain the slurry pumped from the field storage tank, said container having an open top for receiving slurry through said third pump discharge conduit;

b. a rear gate having a first closed position for receiving slurry and a second open position for discharging dewatered formation sand, wherein in said first closed position said rear gate is leak free;

c. a bottom surface having bottom surface slurry dewatering means;

d. a first side wall having a top edge and a bottom edge and having a first side wall slurry dewatering means;

e. a second side wall having a top edge and a bottom edge and having a second side wall slurry dewatering means;

f. a front wall having front wall slurry dewatering means; and,

g. a sump located above said bottom surface for collecting water separated from the slurry,

wherein the container is inclinable by a hydraulic lift so that dewatered sand may be discharged from the rear gate by gravity.

13. The apparatus as claimed in claim 12 wherein said bottom surface slurry dewatering means comprises:

a. a plurality of rectangular filter strips, said plurality of rectangular filter strips having, in relation to the trailer, a foreword edge located proximate to said front wall, a rearward edge located proximate to the rear gate, a first side edge and a second side edge wherein said first and second side edges are parallel to said first and second side walls, and wherein the plurality of rectangular filter strips are mounted parallel to each other and have a length substantially equal to the length of the first and second side walls, and further wherein the plurality of rectangular filter strips are mounted above the bottom surface on a plurality of raised mounts having

a top end and bottom end, said plurality of raised mounts in turn attached to the to the bottom surface by their bottom ends and attached to the plurality of rectangular filter strips by their top ends, so that the plurality of rectangular filters rest above the bottom surface and so that a cavity is formed between the plurality of rectangular filters and the bottom surfaces, and wherein each of the plurality of rectangular filter strips comprising the plurality of rectangular filter strips is mounted in a parallel spaced apart relationship;

b. a plurality of impervious metallic rectangular strips wherein each impervious metallic rectangular strip comprising the plurality of impervious rectangular metallic strips is placed between two adjacent spaced apart rectangular filter strips, and wherein each of the metallic rectangular strips is fixed to the bottom surface by way of a single mount having a top end and a bottom end and a height slightly higher than the adjacent rectangular filter strips, and wherein each of the plurality of impervious metallic rectangular strips have a width sufficiently wide to slightly overlap the adjacent rectangular filter strips, and wherein the single mounts are sufficiently sized to support the weight of slurry material above the impervious metallic rectangular strips and are adapted to prevent the adjacent rectangular filter strips from being crushed by the weight of slurry material above them;

c. a first flow directing means mounted between the rectangular filter strip adjacent the first side wall slurry filtering means for directing downward flow adjacent to the first side wall onto said adjacent rectangular filter strip, wherein said first flow directing means is fabricated from metal and has a length equal to the length of the adjacent rectangular filter strip; and,

d. a second flow directing means mounted between the rectangular filter strip adjacent to the second side wall slurry filtering means for directing downward flow adjacent to the second side wall onto said adjacent rectangular filter strip adjacent to the first side wall filter, wherein said first flow directing means is fabricated from metal and has a length equal to the length of the adjacent rectangular filter strip.

14. The apparatus as claimed in claim 13, wherein said first side wall slurry dewatering means comprises:

a. a first single rectangular filter strip having, in relation to the trailer, a foreword edge located proximate to said front wall, a rearward edge located proximate to the rear gate, a top edge and a bottom edge, wherein said top edge is located below the top edge of the first side wall top edge and wherein the said bottom edge is located above the first side wall bottom edge, and wherein the first single rectangular filter strip is mounted by mounting means to the first side wall in a spaced apart relationship creating a gap between the first side wall and the first single rectangular filter strip; and,

b. a first single impervious metallic capping strip mounted on the top edge of the first rectangular filter strip adapted to prevent slurry from falling behind the first rectangular filter strip.

15. The apparatus as claimed in claim 14, wherein said second side wall slurry dewatering means comprises:

a. a second single rectangular filter strip having, in relation to the trailer, a foreword edge located proximate to said front wall, a rearward edge located proximate to the rear gate, a top edge and a bottom edge, wherein said top edge is located below the top edge of the second side wall top edge and wherein the said bottom edge is located above the second side wall bottom edge, and wherein the second single rectangular filter strip is mounted by mounting means to the second side wall in a spaced apart relationship creating a gap between the second side wall and the second single rectangular filter strip; and,

b. a second single impervious metallic capping strip mounted on the top edge of the second rectangular filter strip adapted to prevent slurry from falling behind the second rectangular filter strip.

16. The apparatus as claimed in claims 13, 14 and 15 wherein said rectangular filter strips comprise:

a. a first layer comprising a mesh having a coarse grid adapted to screen debris and breaking up lumps of slurry;

b. a second layer comprising a mesh having a fine grid adapted to separate water from formation sand in the slurry; and,

c. a third layer comprising a coarse grid mesh adapted to provide support to the said first and second meshes.

17. The apparatus as claimed in claim 16 wherein said front wall filtration means comprise a plurality of alternating rectangular filter strips and impervious metallic strips mounted to the front wall of the container.

18. The apparatus as claimed in claim 17, wherein said apparatus includes oil skimming means for skimming oil floating on top of the oil/water interface on the surface of the slurry within the container, wherein said oil skimming means recycles oil back into the oil field storage tank.

19. The apparatus as claimed in claim 18, wherein said oil skimming means comprises:

a. a directable buoyant oil skimming suction nozzle adapted to float on the surface of the oil/water interface and skim by suction floating oil off of the surface of the oil/water interface; and,

b. a buoyant suction hose having a first intake end and a second discharge end, said first intake end connected to said buoyant oil skimming suction nozzle and said second discharge end connected to the suction intake of the second pump wherein said second pump discharges into the tank.